Relation between emissions and olfactory tests

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Building materials evaluation

Evaluation of the building materials odour = **new odour application** for ULg

Already an experience in the field of environmental odours

No European Standard, the methods are not yet harmonized (working group: ISO 146-6 WG 14: ISO 16000-28 Indoor air: sensory evaluation of emissions from building materials and products)

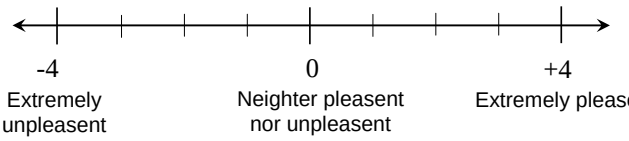
We are inspired by various existing methods to perform odour tests

Sensory evaluation

Quantitative	Qualitative
Concentration: • Dilution factor (EN 13725)	**Quality:** • Description of the odour (M1, GUT label,…)
Intensity: • Magnitude estimation (Indoor Climate Label, VDI 3882(1),…) • Comparative methods with a reference (NFX 43-103, ASTM E544,…)	**Hedonic tone:** • Continuous scale (M1, Indoor Climate Label, GUT label,…) • Category scale (VDI 3882(2))

Selected methods

- Comparative scale of butanol to measure the odour intensity inspired from the ASTM E544-99: Standard Practices for Referencing Suprathreshold Odor
- The hedonic tone according to VDI 3882(2): Determination of Hedonic Odour Tone



- Acceptability: yes/no

Odour intensity measurements

Concentration evaluation of floor coverings odour: all data very weak (<500 uo/m³ ~ detection limit of the olfactometer)

→ **Not useful**

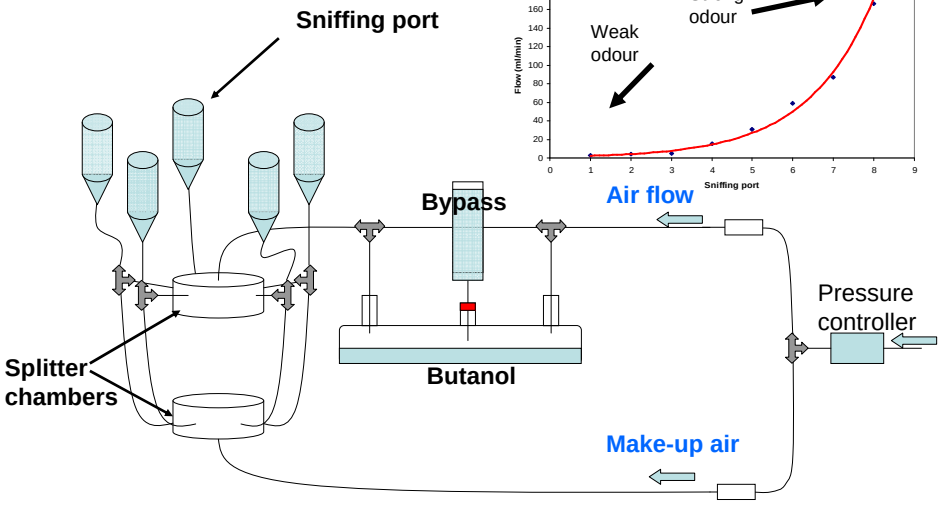
Generation of a butanol scale:

First tests with **static method** liquid butanol is diluted with water into 6 flasks: the inconvenience is that there is no air flow

Dynamic method: an intensity olfactometer has been built to generate 8 different dilutions simultaneously inspired by the ASTM E544

Odour intensity measurements

Our olfactometer:



Odour intensity measurements

Tested materials:

6 Floor coverings were tested:

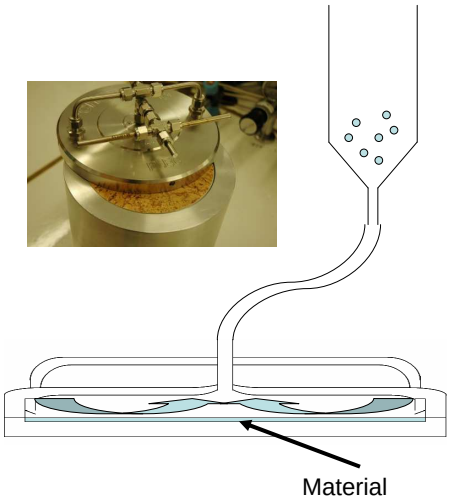
- 2 PVC floor coverings
- 2 linoleums
- 1 carpet
- 1 versatile rubber flooring (older than the other materials)

Odour intensity measurements

Odour Sampling:

Generation of the sample odour from a **FLEC** (**F**ield and **L**aboratory **E**mission **C**ell) on which is connected a funnel at the air output

Tests were performed after 3 days (ongoing systematic tests) with a panel of 8 people

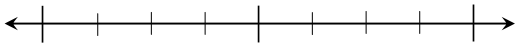


Questionning

Imagine you would have to stay in a room with this odour for an entire day, how would you considerer the odour?

☐ Acceptable ☐ Not acceptable

Mark on point on the scale, which corresponds to the odour sample perception:



-4	0	+4
Extremely unpleasent	Neighter pleasent nor unpleasent	Extremely pleasent

Where would you place the odor intensity of the sample on the scale of butanol concentrations?

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

1 2 3 4 5 6 7 8

Odour results

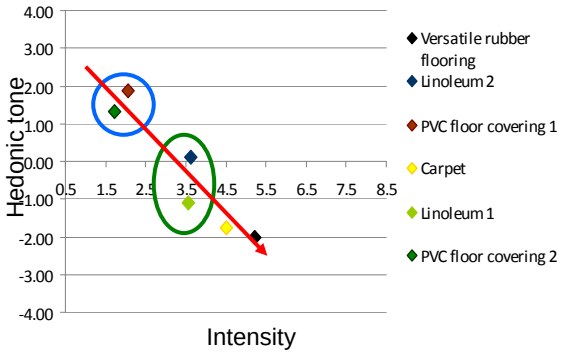
Hedonic tone and intensity:

2 PVC floor coverings

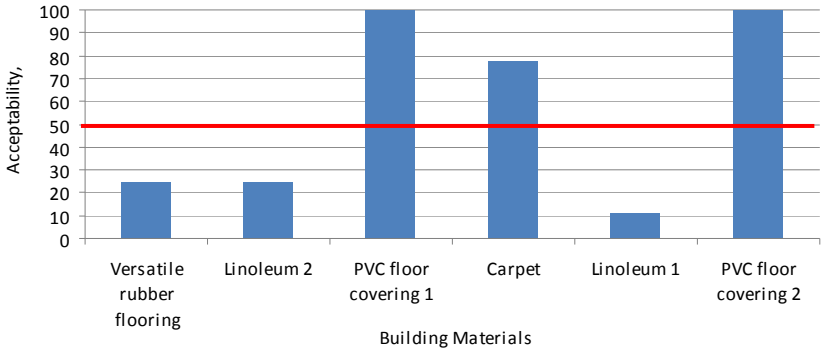
2 linoleums

Carpet

Versatile rubber flooring

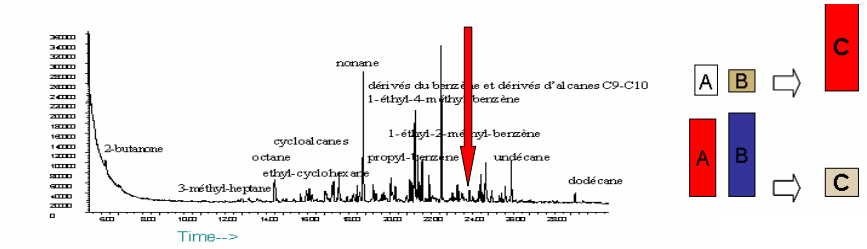


Acceptability results



Relation between emissions and olfactory tests

- Hundreds of odorous and non-odourous compounds participate to smell
- A small amount of one VOC could have a strong odour

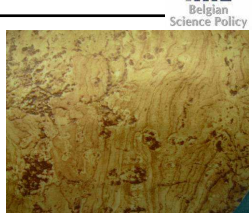


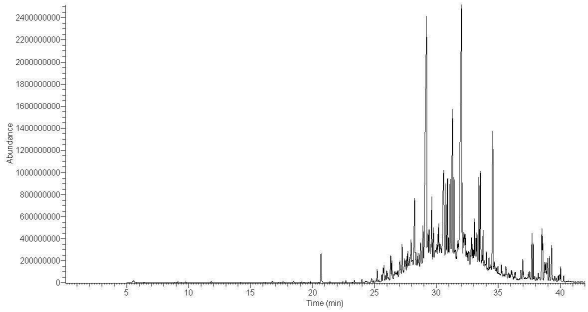
- VOC quantification by tenax evaluates only a part of the total emissions (no VVOC, SVOC, aldehydes, inorganic compounds…)
- A material could have low VOC emissions but a strong odour and inversely

VOC analyses by GC-MS

PVC floor covering:

- High VOC concentrations (TVOC after 3 days = 10720 µg/(m²h))
- Weak odour intensity: sniffing port 2 in average
- Mostly Alkanes

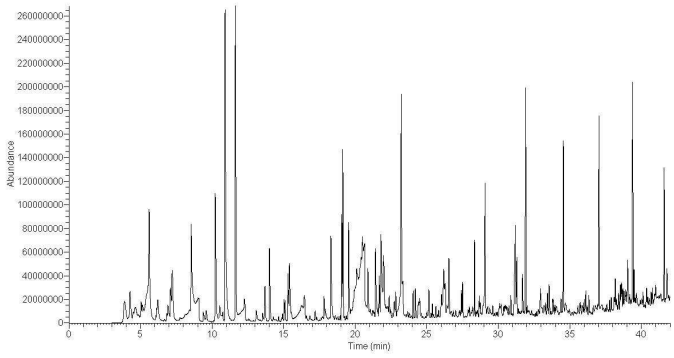




VOC analyses by GC-MS

Linoleum:

- Weak VOC concentrations (TVOC after 3 days = 94 µg/(m²h))
- Strong odour intensity: sniffing port 4 in average
- Mostly carboxylic acids, aldehydes and alkanes



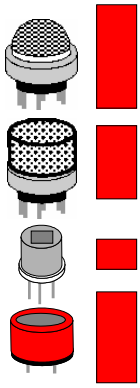
E-nose tests

Chemical analysis ≠ odour

A solution the E-nose = gas sensor array

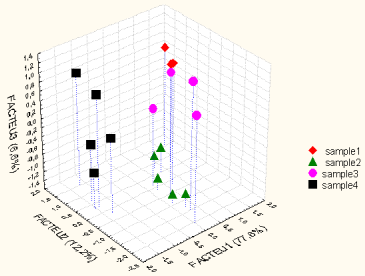
The different gas sensors aren't specific

It gives a global signature of the emissions = a fingerprint



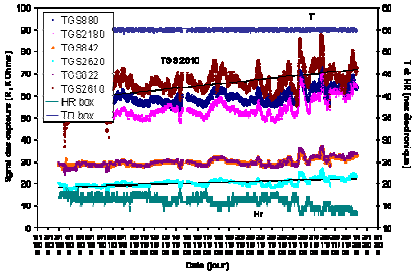
Ongoing E-nose tests

Recognition of the different materials



For more information: see the poster

Continuous material emisssions monitoring during 28 days



Conclusions

- The VOC analysis is not enough, the evaluation of the building materials must take into account of the odour: no obvious relationship between emissions and odour
- For a good evaluation of the building materials odour, three aspects of the odour must be evaluated: the intensity, the hedonic tone and the acceptability
- Odour sample and the reference scale presented by the same way to the panel
- Sensory tests after 28 days: a decrease of the VOC emissions doesn't involve necessarily a weaker odour
- E-nose can be a good instrument but it needs a lot of data (TVOC and odour measurements) (Poster)

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